as a postulate, it would seem to be advisable to banish such phrases as "all whole numbers," and "the same operation can be repeated indefinitely," from elementary texts which make pretensions to rigor.

4. If reasoning by recurrence is, as Poincaré claims, mathematical reasoning *par excellence,* and if the objections put forth in § 3 are not groundless, it would seem to follow that mathematics is like any other science in that the conclusions which it legitimately draws are no more "general" or "universal" than those of other sciences. This contradicts what seems to be a current valuation of mathematical truth in the minds of laymen and some others who hold that mathematics has a timeless, eternal aspect, independent of all the empiricism which characterizes the conclusions of physical sciences.

There is one way of escape which is so obvious that it need only be pointed out. We can beat the mathematical devil round the logical bush by saying that (4) of § 3 is the rule, or law, of inference. But it would be a wise logician indeed who recognized (4) as one of his legitimate children. For where is either a proof of it or its explicit statement as a postulate of logic to be found?

IV. A Practical Printer's Problem in Maxima and Minima.

By Edgar E. DeCou, University of Oregon.

Dean Eric W. Allen, of the School of Journalism of the University of Oregon, presents a very interesting problem of frequent occurrence to the practical printer. The printer's only method of solution is by trial and error; and he states that on a large job of printing an added cost of \$100 or \$200 is often incurred by inability to solve the problem.

The conditions of the problem are as follows: 200,000 (P) prints are required; 1200 (S) prints per hour is the speed of the press; \$2.00 (R) per hour is the cost of running the press; 55 cents (E) each is the cost of the extra electrotypes, needed after the type is once set up. Required the number of electrotypes (x) that should be used to secure the minimum cost (C).

The problem is evidently one in determining the minimum value of C by the use of the differential calculus. The particular case takes the form,

$$C \text{ (in cents)} = \frac{200{,}000 \times 200}{1200(1+x)} + 55x = \frac{100{,}000}{3(x+1)} + 55x,$$

where x represents the number of electrotypes. Differentiating

$$\frac{dC}{dx} = -\frac{100{,}000}{3} \cdot \frac{1}{(x+1)^2} + 55 = 0,$$

for minimum value of C. Hence

$$x = \frac{100}{33} \cdot \sqrt{66} - 1 = 23.6 + .$$

In other words, the most economical number of electrotypes to use for this job is 24. Of course only the nearest integral value of x is used.

The general problem is stated thus:

$$C = \frac{PR}{S(1+x)} + E\cdot x,$$

$$\frac{dC}{dx} = -\frac{PR}{S(1+x)^2} + E = 0,$$

for a minimum.

From which

$$x = \sqrt{\frac{PR}{ES}} - 1.$$

This gives a formula involving only the arithmetical work of finding the square root to determine the number of electrotypes needed in any given case, and one of easy application by any practical printer.

RECENT PUBLICATIONS.

REVIEWS.

Differential Equations. By H. Bateman. London, Longmans, Green and Co., 1918. 8vo. 11 + 306 pp. Price 16 shillings.

The study of elementary methods of integrating differential equations is one which is taken up in many American colleges in a course following the integral calculus, or sometimes as a part of that course. When properly taught, it is a subject admirably adapted to developing in the student a skillful technique in using his calculus, a thing which he will find most helpful in his later work. Many students coming from calculus are woefully weak in many parts of the work which they have studied and "passed," so if such students are to go on to differential equations the beginning, at least, must be easy. They will then have some chance to develop and show their real ability. However, the manipulative side of the study must not be over-emphasized, for the extensive theoretical parts must be suitably developed. Moreover, there is far more opportunity for geometrical discussions than is generally given.

Since the time of Boole many text books on elementary differential equations have appeared in England and America. The general plan of all these books has, however, been much the same. Differential equations were classified into certain "standard forms," and, after having discussed the methods to be used in integrating these type forms, problems were given falling more or less closely under them. The number of real "clothed problems" was usually small. The book here under review is entirely different both in arrangement and content from